surgical repair in the neonatal period. BA is safe and effective in relieving restenosis with a success rate at intermediate follow-up of 95%, in our series, with 80% of patients requiring only one such procedure.

954-146 Sinus Node Dysfunction Following Modified Fontan Operation (Total Cavo-Pulmonary Connection)

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Background: The modified Fontan operation, or total cavopulmonary connection has been a commonly employed palliative surgery for children with single ventricle physiology. Preservation of sinus node function may be especially important following this operation. We evaluated the short-term and intermediate-term effects of the modified Fontan operation on sinus rhythm using 24 hour Holter monitoring.

Methods and Result: From January 1992 to April 1995, 27 patients underwent the modified Fontan operation. Their mean age at the time of surgery was 2.9 ± 0.75 years. Holter monitors were obtained the day prior to surgery, the day prior to hospital discharge, and a minimum of 9 months after surgery. The results were compared to 21 patients undergoing secundum ASD repair, who also had pre-operative and pre-discharge Holters. All patients were in sinus rhythm prior to surgery. Pre-discharge Holter monitors demonstrated sinus rhythm in all patients following ASD repair. Of those undergoing modified Fontan repair 77% (20/26) were in a sinus or atrial rhythm and 23% (6/26) in junctional rhythm post-operatively ($p = 0.01$). Intermediate-term Holters obtained in 22 patients 3.2 ± 1.2 years (mean ± SD) after a modified Fontan repair demonstrated that the incidence of junctional rhythm increased to 41% ($p < 0.001$). Two patients with junctional rhythm developed signs and symptoms of moderate to severe congestive heart failure 4–6 weeks after the surgery which resolved by re-establishing atrial ventricular synchrony with permanent atrial pacing. For patients undergoing a modified Fontan repair there was a significant decrease in average awake heart rate (98 ± 10 vs 115 ± 13, $p < 0.001$) in the intermediate-term post-operative Holter when compared to the pre-operative study. This was also true for average sleeping heart rate (74 ± 13 vs 99 ± 11, $p < 0.0001$), maximum heart rate (142 ± 21 vs 158 ± 21, $p < 0.04$) and minimum HR (57 ± 14 vs 71 ± 13, $p < 0.005$).

Conclusion: Sinus node dysfunction is a common complication of the modified Fontan operation and may worsen with time. It frequently results in chronotropic incompetence and loss of atrioventricular synchrony.

954-147 "Atrioventricular Groove" Tachycardias in Small Children: Clinical Characteristics and Treatment Strategies

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This study examines the clinical characteristics and management options in a group of 4 small children (3 f, 1 m; ages 1–21 mos at presentation) who had both complex atrial and ventricular arrhythmias. The substrate responsible for these arrhythmias most likely involves tumor(s) which traverse the AV groove. All 4 pts had WPW on their EKG at presentation. Initial tachycardias were orthodromic SVT (2), antidromic SVT (1), and VT (1). Three out of the 4 patients had catastrophic episodes of VT with cardiac arrest and/or death. Tumors involving the AV groove were identified by imaging in 2 of 4 pts (MRI and echo). AV groove substrates were confirmed in the other 2 pts by EP data obtained at catheter ablation procedures. Three of the 4 pts are alive and well. One child died suddenly at home from VT on amiodarone and flecainide 6 mos following successful surgery for WPW. One pt was successfully treated with intensive drug therapy (combination Class I, II and III drugs) for VT after the resolution of the WPW syndrome. Two pts were successfully treated with catheter ablation. One of these pts had WPW ablated, but PVCs emanating from the "ventricular end" of the substrate persist. The other pt had WPW and VT originating from the anterior septal region successfully ablated after presenting with cardiac arrest and 6 months of ineffective in-hospital medical treatment of VT. *Conclusion:* Small children with WPW may have complex, lethal atrial and ventricular arrhythmias secondary to tumors traversing the AV groove. Aggressive therapies may be needed to control symptoms and avoid sudden cardiac death.

954-148 The Effects of Verapamil on Fetal Cardiac Mechanics

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Calcium channel blockers may be utilized during pregnancy as a maternal or fetal antiarrhythmic or tocolytic agent. Since the t-tubule and sarcoplasmic reticulum are not fully developed in the fetal heart, it is likely that the negative inotropic effect of calcium channel blockers will be exaggerated in the fetus.

The effect of verapamil on fetal cardiac contractile mechanics was studied in 5 fetal hearts (135 days gestation) employing an isolated isovolumetric contracting preparation. The systolic and diastolic volume-pressure relationship was determined before (control) and after the infusion of subclinical and clinical levels of verapamil.

Verapamil blood levels obtained were sub to low therapeutic in each case (87–146 μg/L). The peak left ventricular developed pressure (LVPDP) and enddiastolic pressure (LVEDP) at a physiologic 5 mm Hg preload were significantly reduced even when verapamil levels were subclinical. The volume-pressure curve was shifted downward.

	Control (mean ± SEM) (mm Hg)	Verapamil Hg) (mean ± SEM) (mm Hg)	p-value
LVEDP	18.4 ± 1.2	9.6 ± 1.5	n.s
LVPDP	65.8 ± 2.4	19.3 ± 2.0	< 0.05

We conclude that Verapamil exerts a severe negative inotropic effect on the fetal heart, far greater than expected from the adult literature. Since we and others have demonstrated placental transfer of verapamil, its use in the pregnant female is relatively contraindicated. Also, since the neonatal heart most likely represents a transition between the fetal and mature myocardium, its use in the pregnant females and neonates should also be questioned.

955 New Treatments for Cardiac Resuscitation

Monday, March 17, 1997, 3:00 p.m.–5:00 p.m.
Anaheim Convention Center, Hall E
Presentation Hour: 4:00 p.m.–5:00 p.m.

955-167 Right Ventricular Dysfunction Following Successful Resuscitation From Prolonged Cardiac Arrest

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Resuscitation following 10 to 15 minutes of untreated ventricular fibrillation results in a traumatic decrease in left ventricular systolic and diastolic function. To evaluate the effect of prolonged cardiac arrest and resuscitation on right ventricular function 28 swine, 16 control animals and 12 which received Dobutamine (10 μg/kg/min) were studied for 5 hours post-resuscitation. Each was instrumented with solid state micromanometer-tipped pigtail catheters to measure right ventricular end-diastolic pressure and perform right ventricular angiography to calculate right ventricular ejection fraction. A 10 to 15 minute period of ventricular fibrillation followed by resuscitation was utilized. There were significant differences over time in both end-diastolic pressure and ejection fraction in the control group. Table 1 shows the differences at 30 minutes and 2 hours between animals receiving no treatment and those receiving Dobutamine.

	Controls	Dobutamine	"p"
RVEDP (mmHg)			
Baseline	5 ± 1	4 ± 1	0.88
30 min.	8 ± 1	4 ± 1	0.004
2 hr.	4 ± 1	4 ± 1	0.84
5 hr.	5 ± 1	3 ± 1	0.23
RVEF (%)			
Baseline	50 ± 2	50 ± 2	0.97
30 min.	34 ± 2	42 ± 4	0.13
2 hr.	40 ± 2	49 ± 2	0.01
5 hr.	41 ± 2	47 ± 4	0.14

Prolonged cardiac arrest followed by successful resuscitation results in significant right ventricular dysfunction. Dobutamine can significantly improve this post-resuscitation right ventricular dysfunction.

955-168 Comparison of Epinephrine and Phenylephrine in Resuscitation From Cardiac Arrest Using Selective Aortic Perfusion and Oxygenation

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Purpose: To compare epinephrine (EPI) and phenylephrine (PHE) as intra-